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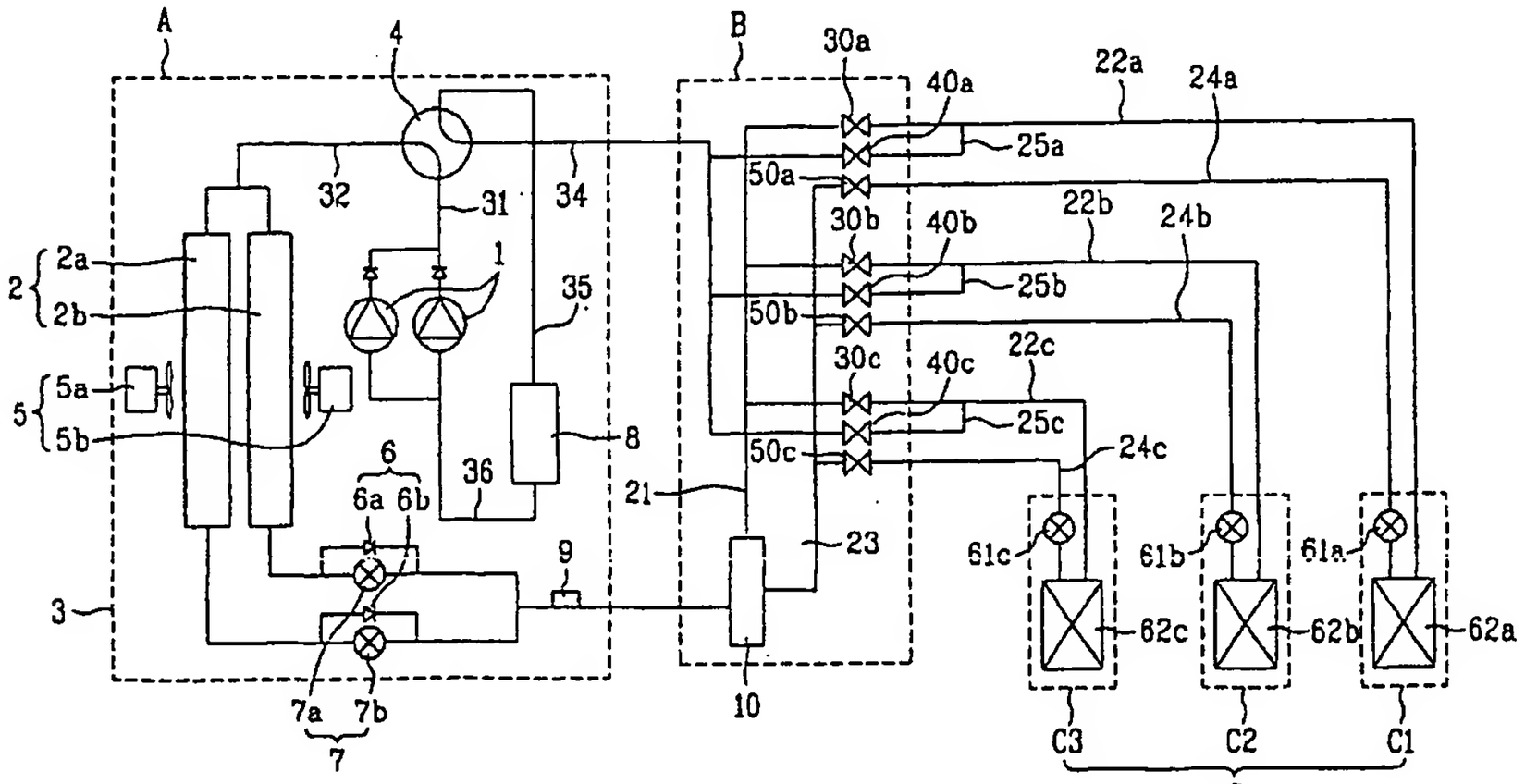
(54) Multi-unit air conditioner and method for controlling the same

(57) Multi-unit air conditioner and method for controlling the same, the multi-unit air conditioner including a plurality of outdoor heat exchangers 2, a plurality of outdoor fans 15 for cooling the outdoor heat exchangers 2, and control means 9 for controlling rotation speeds of the outdoor fans 15, to control a gas/liquid refrigerant mixing ratio introduced into the gas-liquid separator 10 through the outdoor heat exchangers 2, thereby optimizing the mixing ratio of the refrigerant introduced to a gas-liquid separator 10 proper to an operation condition, for improving an air conditioning efficiency. The control means include a temperature sensor 9 for measuring a temperature of refrigerant introduced from the outdoor heat exchangers 2 into the gas-liquid separator 10, and a microcomputer for comparing a refrigerant temperature measured with the temperature sensor 9 and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling rotation speeds of the outdoor fans 5 so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively.

FIG.1



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at the second outdoor heat exchanger.

[0016] The control means includes a temperature sensor for measuring a temperature of refrigerant introduced from the outdoor heat exchangers into the gas-liquid separator, and a microcomputer for comparing a refrigerant temperature measured with the temperature sensor and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling rotation speeds of the outdoor fans so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively. The refrigerant is R407C mix refrigerant of which refrigerant mixing ratio can be known accurately according to a temperature variation.

[0017] The outdoor unit piping system includes a first pipeline connected between outlets of the compressors and the four way valve, a second pipeline branched into two pipeline in front of the first and second ouldoor heat exchangers, and connected between the four way valve and the first and second outdoor heat exchangers in parallel, a third pipeline joined in front of the gas-liquid separator, and connected between the gas-liquid separator and the outdoor heat exchangers in parallel, a fourth pipeline connected between the distribution piping system and the four way valve, a fifth pipeline connected between the four way valve and the accumulator, and a sixth pipeline connected between the accumulator and an inlet of the compressor.

[0018] The outdoor heat exchangers include a first outdoor heat exchanger for discharging liquid refrigerant proper to an operation condition, and a second outdoor heat exchanger for discharging two phased refrigerant proper to the operation condition. The outdoor fans include a first outdoor fan for condensing refrigerant at the first outdoor heat exchanger, and a second outdoor fan for condensing refrigerant at the second outdoor heat exchanger.

[0019] The control means includes a temperature sensor provided at a part the third pipeline joins for measuring a temperature of refrigerant introduced from the first and second outdoor heat exchangers into the gas-liquid separator, and a microcomputer for comparing a refrigerant temperature measured with the temperature sensor and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling a rotation speed of the second outdoor fan so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively.

[0020] The control valve includes first, and second check valves provided on sides of the first, and second outdoor heat exchangers of the third pipeline for controlling a refrigerant flow from the first and second outdoor heat exchangers to the gas-liquid separator, and first and second electronic expansion valves provided in parallel with the first and second check valves for expanding refrigerant flowing from the gas-liquid separator to the first and second outdoor heat exchangers.

[0021] The distribution piping system includes a liquid refrigerant pipeline connected to the gas-liquid separator for guiding liquid refrigerant to/from the gas-liquid separator, liquid refrigerant branch pipelines branched from the liquid refrigerant pipeline, and connected to the indoor heat exchangers respectively, a gas refrigerant pipeline connected to the gas-liquid separator for guiding gas refrigerant to/from the gas-liquid separator, gas refrigerant branch pipelines branched from the gas refrigerant pipeline and connected to the indoor heat exchangers, respectively, and intermediate branch pipelines respectively branched from the gas refrigerant branch pipelines, and connected to the outdoor unit piping system.

[0022] The gas refrigerant branch pipelines and the liquid refrigerant branch pipelines are arranged in parallel to each other for piping work efficiency. The outdoor heat exchanger includes a first outdoor heat exchanger for discharging liquid refrigerant proper to an operation condition, and a second outdoor heat exchanger for discharging two phased refrigerant proper to the operation condition. The outdoor fans include a first outdoor fan for condensing refrigerant at the first outdoor heat exchanger, and a second outdoor fan for condensing refrigerant at the second outdoor heat exchanger.

[0023] The outdoor unit piping system includes a first pipeline connected between outlets of the compressors and the four way valve, a second pipeline branched into two pipeline in front of the first and second outdoor heat exchangers, and connected between the four way valve and the first and second outdoor heat exchangers in parallel, a third pipeline joined in front of the gas-liquid separator, and connected between the gas-liquid separator and the first and second outdoor heat exchangers in parallel, a fourth pipeline connected between the intermediate branch pipelines and the four way valve, a fifth pipeline connected between the four way valve and the accumulator, and a sixth pipeline connected between the accumulator and the inlet of the compressor.

[0024] The control means includes a temperature sensor provided at a part the third pipeline joins for measuring a temperature of refrigerant introduced from the first and second outdoor heat exchangers into the gas-liquid separator, and a microcomputer for comparing a refrigerant temperature measured with the temperature sensor and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling a rotation speed of the second outdoor fan so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively.

[0025] The control valve includes first, and second check valves provided on sides of the first, and second outdoor heat exchangers of the third pipeline for controlling a refrigerant flow from the first and second outdoor heat exchangers to the gas-liquid separator, and first and second electronic expansion valves provided

[0038] The outdoor fans 5 include first and second outdoor fans 5a, and Sb. The first and second outdoor fans 5a and Sb are designated such that the first outdoor fan 5a condenses refrigerant from the first outdoor heat exchanger 2a, and the second outdoor fan 5b condenses refrigerant from the second outdoor heat exchanger 2b.

[0039] In the meantime, the control means includes a temperature senor 9 and a microcomputer (not shown). The temperature sensor measures a temperature of the refrigerant introduced from the first, and second outdoor heat exchangers 2a and 2b into the gas-liquid separator 10. The microcomputer compares the refrigerant temperature measured with the temperature sensor 9 to a preset refrigerant temperature, to detect the refrigerant mixing ratio in the outdoor unit. The microcomputer also controls rotation speeds of the outdoor fans 5 so that detected refrigerant mixing ratios are respectively the same with the refrigerant mixing ratios presel proper to different operation conditions. In this instance, it is preferable that the microcomputer is designed to control the rotating speed of the second outdoor fan 5b. It is also preferable that the refrigerant is one of which gas/liquid mixing ratio can be known accurately, preferably R407C.

[0040] The outdoor unit piping system includes a refrigerant path from the outlet of the compressor 1 to the gas-liquid separator 10 or the distribution piping system, and a refrigerant path from the distribution piping system or the gas-liquid separator 10 to the inlet of the compressor 1. The paths are controlled by the four way valve 4. That is, the four way valve 4 makes the outdoor unit piping system on an outlet side of the compressor 1 to be in communication with each other to fix the refrigerant path from the compressor 1, which will be described in more detail.

[0041] The outdoor unit piping system includes six pipelines. A first pipeline 31 connects the outlets of the compressors 1 and the four way valve 4. A second pipeline 32 is connected to the four way valve 4, branched into two pipeline in front of the first and second outdoor heat exchangers 2a and 2b, and connected to the first and second outdoor heat exchangers 2a and 2b. Therefore, the second pipeline 32 connects the first, and second outdoor heat exchangers 2a, and 2b in parallel.

[0042] A third pipeline 33 is respectively connected to the first and second outdoor heat exchangers 2a and 2b, joins in front of the gas-liquid separator 10, and connected to the gas-liquid separator 10, to connect the first and second outdoor heat exchangers 2a and 2b and the gas-liquid separator 10 in parallel. The temperature sensor 9 of the control means is provided at a joined point of the third pipeline 33. A fourth pipeline 34 connects the distribution piping system and the four way valve 4, and a fifth pipeline 35 connects the four way valve 4 and the accumulator 8. Lastly, a sixth pipeline 36 connects the accumulator 8 and the inlet of the compressor 1.

[0043] At the end, the four way valve 4 is connected to the first, second, third and fourth pipelines 31, 32, 34, and 35, respectively. The four way valve 4 connects the pipelines selectively depending on operation conditions, and fixes a refrigerant path.

[0044] For an example, referring to FIG. 2A or 3A, when the multi-unit air conditioner is in a cooling mode, the four way valve 4 connects the first pipeline 31 and the second pipeline 32, so as to introduce the refrigerant from the compressor 1 to the outdoor heat exchangers 2a and 2b.

[0045] Referring to FIG. 2B or 3B, when the multi-unit air conditioner is in a heating mode, the four way valve 4 connects the first pipeline 31 and the fourth pipeline 34, so as to introduce the refrigerant from the compressor 1 to the distribution piping system.

[0046] The cooling mode refers to a case when the multi-unit air conditioner only cools the rooms, or is operated mainly for cooling, and the heating mode refers to a case when the multi-unit air conditioner only heats the rooms, or is operated mainly for heating.

[0047] Variation of the refrigerant flow path with operation conditions will become more apparent by description of operation of the multi-unit air conditioner with reference to the attached drawings, given later.

[0048] In the meantime, the control valves 6 and 7 include first and second check valves 6a and 6b provided on the third pipeline 33, and first, and second electronic expansion valves 7a and 7b. The first and second check valves 6a and 6b are provided on the first and second outdoor heat exchangers 2a, and 2b, for controlling refrigerant flow from the first and second outdoor heat exchangers 2a and 2b to the gas-liquid separator 10.

[0049] In more detail, the first and second check valves 6a and 6b pass refrigerant introduced from the first and second outdoor heat exchangers 2a and 2b to the gas-liquid separator 10 only. The first and second electronic expansion valves 7a and 7b, mounted in parallel to the first and second check valves 6a and 6b, causes to expand the refrigerant introduced from the gas-liquid separator 10 to the first and second outdoor heat exchangers 2a and 2b only. At the end, the refrigerant introduced from the first and the second outdoor heat exchangers 2a and 2b to the gas-liquid separator 10 is made to flow through the first and second check valves 6a and 6b, and the refrigerant introduced from the gas-liquid separator 10 to the first and second outdoor heat exchangers 2a and 2b is made to flow through the first and second electronic expansion valves 7a and 7b.

[0050] The distributor 'B' is provided between the outdoor unit 'A' and the plurality of indoor units C1, C2, and C3. As described, the distributor 'B' includes the gas-liquid separator 10 and the distribution piping system.

[0051] The distribution piping system includes a liquid refrigerant pipeline 23, liquid refrigerant branch pipelines 24a, 24b, and 24c, a gas refrigerant pipeline 21, gas refrigerant branch pipelines 22a, 22b, and 22c, and intermediate branch pipelines 25a, 25b, and 25c.

lines 25a, 25b, and 25c through the gas refrigerant branch pipelines 22a, 22b, and 22c. In this instance, the two way valves 30a, 30b, and 30c on the gas refrigerant branch pipelines are closed. Then, the refrigerant is introduced into the fifth pipeline 35 through the fourth pipeline 34 by the four way valve 4. Then, the refrigerant is drawn into the compressor 1 through the sixth pipeline 36 through the accumulator 8.

[0065] Referring to FIG. 2B, when the multi-unit air conditioner of the present invention only cools the rooms, the gas refrigerant from the compressor 1 flows through the first pipeline 31. Then, the refrigerant is introduced into the intermediate branch pipelines 25a, 25b, and 25c through the fourth pipelines 34 by the four way valve 4. Thus, different from the case when the refrigerant cools the rooms, the gas refrigerant does not pass through the outdoor heat exchangers 2.

[0066] Then, the gas refrigerant heats the rooms as the gas refrigerant is introduced into the gas refrigerant branch pipelines 22a, 22b, and 22c, passes, and condenses through the indoor heat exchangers 62a, 62b, and 62c. The refrigerant is introduced into the gas-liquid separator 10 through the electronic expansion valves 61a, 61b, and 61c, the liquid refrigerant branch pipelines 24a, 24b, and 24c, and the liquid refrigerant pipeline 23. The refrigerant flows from the gas-liquid separator 10 to, and expands at the first and second electronic expansion valves 7a, and 7b, and is introduced into the first and second heat exchangers 2a and 2b. Then, the refrigerant is drawn into the compressor 1 through the four way valve 4 and the accumulator 8.

[0067] Referring to FIG. 3A, when the multi-unit air conditioner of the present invention is operated in a major cooling mode, the gas refrigerant from the compressor 1 flows through the first pipeline 31. Then, the refrigerant is introduced into the first and second outdoor heat exchangers 2a and 2b through the second pipeline 32 by the four way valve 4. In this instance, the refrigerant introduced into the first outdoor heat exchanger 2a is subcooled by the air blowing of the first outdoor fan 5a. Then, the refrigerant introduced into the second outdoor heat exchanger 2b becomes two phased refrigerant having a refrigerant mixing ratio required for an operation condition by the air blowing of the second outdoor fan 5b. As described before, a rotating speed of the second outdoor fan Sb is determined by the control means having the temperature sensor 9 and the microcomputer.

[0068] Thereafter, the refrigerant flow through the third pipeline 33, and introduced into the gas-liquid separator 10 through the first and second check valves 6a, and 6b. In this instance, the first and second electronic expansion valves 7a, and 7b mounted in parallel to the first and second check valves 6a and 6b are closed.

[0069] In the meantime, the refrigerant mixing ratio of the refrigerant introduced into the gas-liquid separator 10 is controlled to be the same with a refrigerant mixing ratio preset by the control means. The refrigerant mixing ratio is determined to be proper to the two indoor units C2 and C3 for cooling which require liquid refrigerant and the indoor unit C1 for heating which requires gas refrigerant. The refrigerant mixing ratio is also determined with reference to a flow rate of the refrigerant introduced into the two indoor units C2 and C3 for cooling through the one indoor unit C1 for heating. Thus, the refrigerant mixing ratio is an experimental value determined by an experiment carried out under different conditions.

[0070] The high pressure two phased refrigerant introduced into the gas-liquid separator 10 is separated into liquid refrigerant and gas refrigerant. The liquid refrigerant is introduced into the liquid refrigerant pipeline 23 and branched to the liquid refrigerant branch pipelines 24b and 24c. Thereafter, the liquid refrigerant expands as the refrigerant passes through the electronic expansion valves 61b and 61c of the indoor units C2 and C3, and evaporated, and cool the rooms as the refrigerant passes through the indoor heat exchangers 62b and 62c.

[0071] In the meantime, separated gas refrigerant is introduced into the gas refrigerant pipeline 21. Then, the gas refrigerant is introduced into selected gas refrigerant branch pipeline 22a, and heats the room which requires heating as the refrigerant passes through the indoor heat exchanger 62a. Then, the refrigerant, passed through the indoor heat exchanger 62a, passes through opened electronic expansion valve 61a of the indoor unit C1, and the liquid refrigerant branch pipeline 24a, and introduced into the liquid refrigerant pipeline 23, and joins with the liquid refrigerant.

[0072] Thus, the gas refrigerant separated at the gas-liquid separator 10 also cools the rooms together with the liquid refrigerant separated at the gas-liquid separator 10 after the gas refrigerant heats the rooms.

[0073] The liquid refrigerant is introduced only into the selected liquid refrigerant branch pipelines 24b and 24c because of a pressure difference of the refrigerant. In more detail, a pressure of the liquid refrigerant from the liquid refrigerant branch pipeline 24a is controlled to be higher than a pressure of the refrigerant into the liquid refrigerant branch pipelines 24a. According to this, the liquid refrigerant is introduced only into the selected liquid refrigerant branch pipelines 24b and 24c.

[0074] The refrigerant evaporated as the refrigerant passes through the indoor heal exchangers 62b and 62c is introduced into the intermediate branch pipelines 25b and 25c through the gas refrigerant branch pipelines 22b and 22c. In this instance, the two way valves 30b and 30c are closed. Thereafter, the refrigerant flows through the fourth pipeline 34, and introduced into the fifth pipeline 35 by the four way valve 4. Then, the refrigerant is drawn into the compressor 1 through the sixth pipeline 36 and the accumulator 8.

[0075] Referring to FIG. 3B, when the multi-unit air conditioner of the present invention is operated in a major heating mode, the gas refrigerant from the compres-

liquid separator, and a microcomputer for comparing a refrigerant temperature measured with the temperature sensor and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling rotation speeds of the outdoor fans so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively.

Claims

1. A multi-unit air conditioner comprising:

an outdoor unit (A) including:

an accumulator(8), a plurality of compressors (1) and outdoor heat exchangers (2) connected with an outdoor unit piping system, a plurality of outdoor fans (5) for respectively cooling the outdoor heat exchangers (2), a four way valve (4) and a plurality of control valves (6, 7) mounted on the outdoor unit piping system for controlling refrigerant flow;

a plurality of indoor units (C) respectively installed in rooms each having an indoor heat exchanger (62a-c) and an electronic expansion valve (61a-c);

a distributor (B) including a gas-liquid separator (10) for separating refrigerant received from the outdoor unit (A) into gas refrigerant and liquid refrigerant, or mixing refrigerant received from the indoor units (C), and a distribution piping system for guiding the refrigerant from the outdoor unit (A) toward the indoor units (C) and the refrigerant from the indoor units (C) to the outdoor unit again; and

control means (9) for controlling rotation speeds of the outdoor fans (5), to control a gas /liquid refrigerant mixing ratio introduced into the gas-liquid separator (10) through the outdoor heat exchangers (2).

2. The multi-unit air conditioner as claimed in claim 1, wherein the outdoor heat exchanger (2) includes:

a first outdoor heat exchanger (2a) for discharging liquid refrigerant proper to an operation condition; and

a second outdoor heat exchanger (2b) for discharging two phased refrigerant proper to the operation condition.

3. The multi-unit air conditioner as claimed in claim 1 or 2, wherein the outdoor fan includes:

a first outdoor fan (5a) for condensing refrigerant at the first outdoor heat exchanger (2a) ; and

a second outdoor fan (5a) for condensing refrigerant at the second outdoor heat exchanger (2b).

4. The multi-unit air conditioner as claimed in one of claims 1 to 3, wherein the control means includes:

a temperature sensor (9) for measuring a temperature of refrigerant introduced from the outdoor heat exchangers (2) into the gas-liquid separator (10), and

a microcomputer for comparing a refrigerant temperature measured with the temperature sensor (9) and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and

controlling rotation speeds of the outdoor fans (5) so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper to operation conditions, respectively.

5. The multi-unit air conditioner as claimed in claim 4, wherein the refrigerant is R407C mix refrigerant of which refrigerant mixing ratio can be known accurately according to a temperature variation.

6. The multi-unit air conditioner as claimed in one of claims 1 to 5, wherein the outdoor unit piping system includes:

a first pipeline (31) connected between outlets of the compressors (1) and the four way valve (4),

a second pipeline (32) branched into two pipeline in front of the first and second outdoor heat exchangers (2a, 2b), and connected between the four way valve (4) and the first and second outdoor heat exchangers (2a, 2b) in parallel,

a third pipeline (33) joined in front of the gas-liquid separator (10), and connected between the gas-liquid separator (10) and the outdoor heat exchangers in parallel,

a fourth pipeline (34) connected between the distribution piping system and the four way valve (4),

a fifth pipeline (35) connected between the four

a second outdoor fan (5b) for condensing refrigerant at the second outdoor heat exchanger (2b).

15. The multi-unit air conditioner as claimed in claim 14, wherein the outdoor unit piping system includes:

a first pipeline (31) connected between outlets of the compressors (1) and the four way valve (4),

a second pipeline (32) branched into two pipeline in front of the first and second outdoor heat exchangers (2a, 2b), and connected between the four way valve (4) and the first and second outdoor heat exchangers (2a, 2b) in parallel,

a third pipeline (33) joined in front of the gas-liquid separator (10), and connected between the gas-liquid separator (10) and the first and second outdoor heat exchangers (2a, 2b) in parallel,

a fourth pipeline (34) connected between the intermediate branch pipelines (25a-c) and the four way valve (4),

a fifth pipeline (35) connected between the four way valve (4) and the accumulator(8), and

a sixth pipeline (36) connected between the accumulator (8) and the inlet of the compressor (1).

16. The multi-unit air conditioner as claimed in claim 15, wherein the control means includes:

a temperature sensor (9) provided at a part the third pipeline (33) joins for measuring a temperature of refrigerant introduced from the first and second outdoor heat exchangers (2a, 2b) into the gas-liquid separator (10), and

a microcomputer for comparing a refrigerant temperature measured with the temperature sensor (9) and a preset refrigerant temperature, to detect a refrigerant mixing ratio at the outdoor unit piping system, and controlling a rotation speed of the second outdoor fan (56) so that detected refrigerant mixing ratios are the same with refrigerant mixing ratios preset to be proper

to operation conditions, respectively.

17. The multi-unit air conditioner as claimed in claim 15 or 16, wherein the control valve (6,7) includes:

first, and second check valves (6a, 6b) provided on sides of the first, and second outdoor heat exchangers (2a, 2b) of the third pipeline (33) for controlling a refrigerant flow from the first and second outdoor heat exchangers (2a, 2b) to the gas-liquid separator (10), and

first and second electronic expansion valves (7a, 7b) provided in parallel with the first and second check valves (6a, 6b) for expanding refrigerant flowing from the gas-liquid separator (10) to the first and second outdoor heat exchangers (2a, 2b).

18. The multi-unit air conditioner as claimed in one of claims 11 to 17, wherein the distributor (B) includes a valve unit for controlling refrigerant flow in the distribution piping system.

19. The multi-unit air conditioner as claimed in claim 18, wherein the valve unit includes two way valves (30a-c, 40a-c, 50a-c) provided on the gas refrigerant branch pipelines (22a, 22b), the liquid refrigerant branch pipelines (24a-c), and intermediate branch pipelines (25a-c) for being turned on/off selectively depending on operation conditions.

20. A method for operating a multi-unit air conditioner, comprising the steps of:

measuring a temperature of refrigerant introduced into a gas-liquid separator (10) through an outdoor unit piping system from a plurality of outdoor heat exchangers (2) with a temperature sensor (9);

comparing a measured refrigerant temperature and a preset refrigerant temperature, to detect a refrigerant mixing ratio flowing through the outdoor unit piping system; and

controlling rotation speeds of a plurality of outdoor fans (5) for cooling the outdoor heat exchangers (2), so that the detected mixing ratio becomes the same with a mixing ratio set proper to an operation condition.

FIG.2A

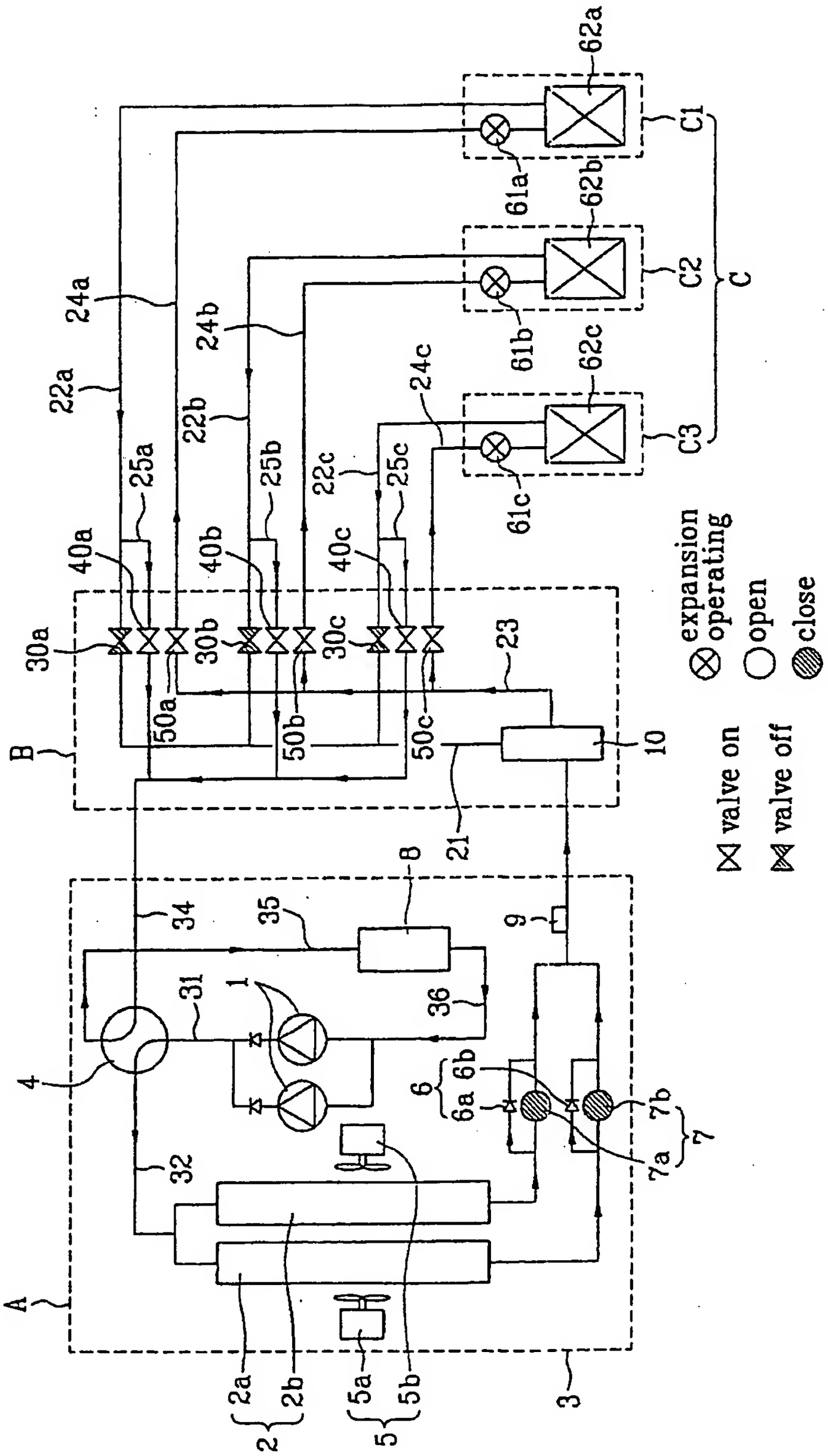
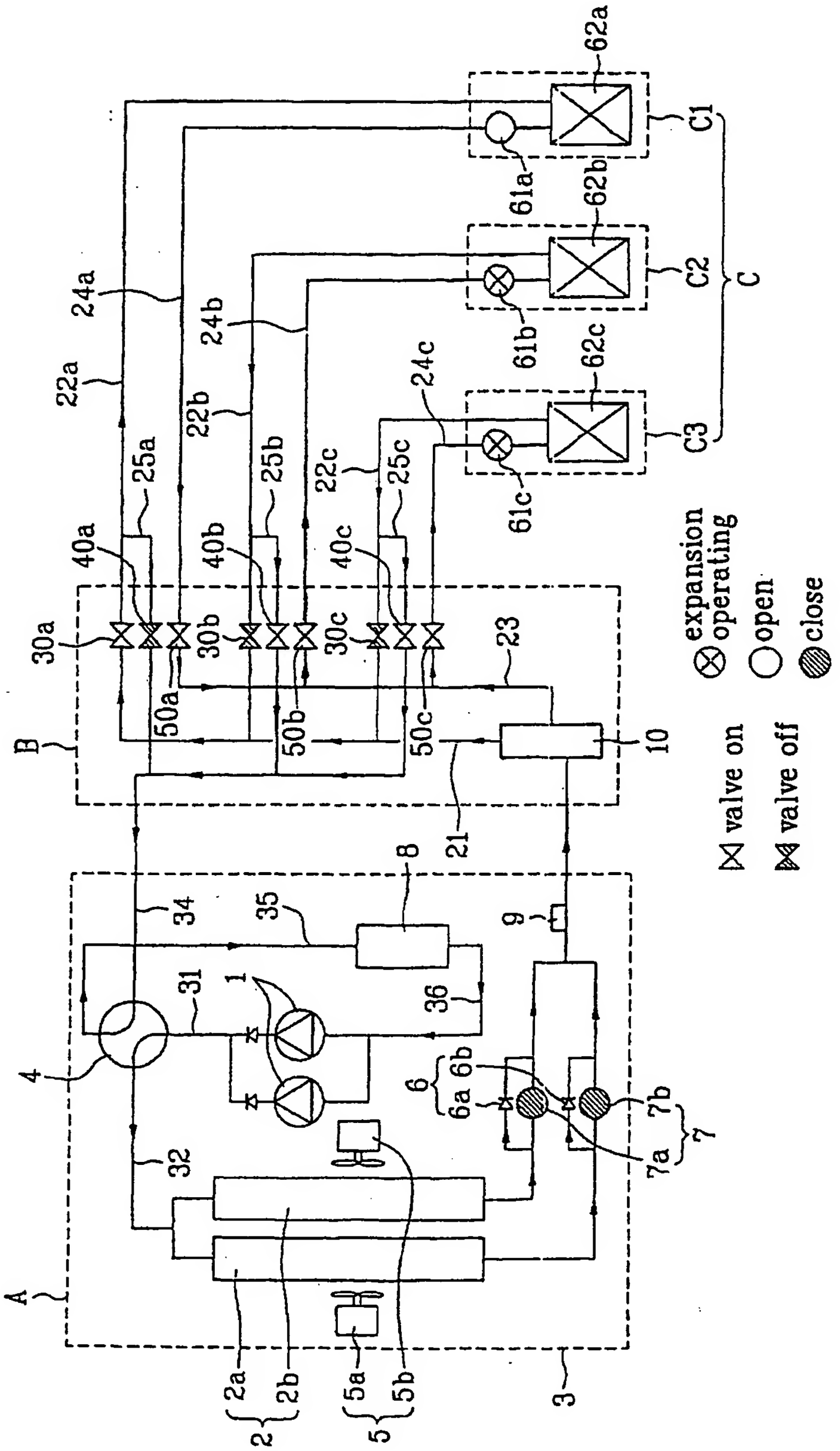

62a
C1
61a
62b
C2
C
24a
24b
61b
62c
24c
22a
22b
22c
25a
25b
25c
C3
61c
40a
40b
40c
30a
30b
30c
23
50a
50b
50c
B
10
21
8
34
35
9
31
1
36
4
6
6a 6b
7b
7
7a
32
A
2a
2b
2
5a
5b
5
3
expansion operating
open
valve on
valve off
close

FIG.3A



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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 3228

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 448 345 A (MITSUBISHI ELECTRIC CORP) 25 September 1991 (1991-09-25) * abstract; figure 9 * ---	1-20	F24F3/06 F25B13/00 F25B41/04 F24F11/00
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F24F
F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	26 August 2003	Valenza, D

CATEGORY OF CITED DOCUMENTS

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26-08-2003

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Zeichen/Ref./Réf.	Anmeldung Nr./Application No./Demande n°./Patent Nr./Patent No./Brevet n°.
PH/P35909EP	03255182.2 - -

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LG ELECTRONICS INC.

COMMUNICATION

The European Patent Office herewith transmits

- [X] the European search report
- [ ] the declaration under Rule 45 EPC
- [ ] the partial European search report under Rule 45 EPC
- [ ] the supplementary European search report concerning the international application under Article 157(2) EPC relating to the above-mentioned European patent application. Copies of the documents cited in the search report are enclosed.

The following specifications given by the applicant have been approved by the Search Division :

[X] Abstract [X] Title [X] Figure

- [ ] The abstract was modified by the Search Division and the definitive text is attached to this communication.
- [ ] The following figure will be published with the abstract, since the Search Division considers that it better characterises the invention than the one indicated by the applicant.

Figure:

- [X] Additional copy(copies) of the documents cited in the European search report.

REFUND OF THE SEARCH FEE

If applicable under Article 10 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-12,14,15

Independent claims 1, 14 and 15 relate to an air conditioner/an operation method of an air conditioner which uses a selective expansion unit

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2. claims: 13,16

Independent claims 13 and 16 relate to the control of an otdoor heat exchanger fan

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 25 5182

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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F25B
F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 June 2005	Ritter, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 June 2005	Ritter, C

CATEGORY OF CITED DOCUMENTS

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